Appl. No.	:	10/652,587
Confirmation No.	:	9149
Applicant	:	Pratima Bajpai, et al.
Filed	:	August 29, 2003
Title	:	Eucalyptus Biokraft Pulping Process
TC/A.U.	:	1731
Examiner	:	Alvo, Marc S
Docket No.	:	016260-9005-02
Customer No.		23510

I, Sandy Tabachnick, hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date of my signature.

Sandy Tabachnick
Signature

July 22, 2005
Date of Signature

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF MASOOD AKHTAR, UNDER 37 C.F.R. § 1.132

1. I am the Chief Executive Officer of Biopulping International, Inc. (hereinafter, "Biopulping International"), located at 2912 Syene Rd., Wisconsin, a position I have held since June 2000. Prior to that, I was Vice President of Research and Development at Biopulping International from November 1996 to May 2000, and a Microbiologist and Project leader at the Institute for Microbial and Biochemical Technology, U.S.D.A. - Forest Service, Forest Products Laboratory, Madison, Wisconsin from 1989 to 1996.

2. I received a Bachelor of Science Degree in Botany, Zoology, and Chemistry from Rohilkand University in India in 1978. I received a Doctorate degree in Microbiology (Botany) from Aligarh Muslim University in India in 1985. I have worked in the field of Biotechnology, specializing in exploring uses of microrganisms in the paper industry since at least as early as 1989. I am a member of the Technical Association of the Pulp and Paper Industry, and have served on the national and international committees dealing with biotechnology in the pulp and paper industry. Attached hereto, as Exhibit A, is a copy of my *curriculum vitae*.

3. I have recevied the following honors: 1998 Federal Laboratory Consortium Award, 1998 U.S. Forest Service Chief's Award for excellence in biopulping technology transfer, 1997 USDA Honor Award for developing biopulping technology, 1997 from the U.S. Secretary of Agriculture.

4. I am the co-inventor of the claimed subject matter of the above identified patent application. I make this declaration in support of prosecution of the application before the U.S. Patent and Trademark Office.

5. I have read and understood the invention as disclosed in the above identified patent application, including the invention described by the presently pending claims, after amendment in the Amendment and Request for consideration, under 37 C.F.R. § 1.111, to be filed herewith.

6. I have reviewed an Office Action from the U.S. Patent and Trademark Office, mailed April 2, 2002. Claims 18 and 19 stand rejected under 35 U.S.C. § 102 (b) as anticipated by, or in the alternative under 35 U.S.C. § 103 (a) as obvious over Yang, TAPPI J., Vol. 76, No. 7 (hereinafter "Yang"). Claims 1, 2, 4, 11-14, 16, 18 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,851,351 (hereinafter "Baecker") in view of Yang. Claims 15 and 17 stand rejected under 35 USC § 103(a) over Baecker in view of Yand and Akhtar, U.S. Patent No. 5,620,564 (hereinafter the "564 Patent"). I believe the evidence presented hereinbelow demonstrates the subject matter of the pending claims is not taught or suggested by any one of the references or by the combination of references cited as basis for the rejection in the Office Action, cited above.

7. Claims 1-17 are directed towards methods of biokraft pulping eucalyptus wood chips. Claim 18 is directed towards biotreated eucalyptus wood chips. Claim 19 is directed towards a method of making paper from biokraft pulped eucalyptus wood chips.

8. In the methods of the present invention, eucalyptus wood chips are inoculated with white rot fungi and are allowed to ferment, so as to cause propagation of the fungus through the

wood chips and obtain chemically modified lignin. The biotreated eucalyptus wood chips are then pulped by a known kraft process.

9. While a certain amount is known about the interaction of lignin and cellulose in wood fibers, because of the extreme complexity of the relationships, and the variation in the enzymes produced by varieties of the white-rot fungi, it is not readily possible to predict from the action of a given fungus on a given type of wood whether or not the paper made from wood partially digested with such fungus will have desirable qualities or not. The selection of white-rot fungi for biopulping applications on the basis of selective lignin degradation may seem a rational one, but it has proven to be a poor predictor of the quality of the resultant paper. The exact relationship between the degradation of lignin, and the resulting desirable qualities of paper produced at the end of the pulping process, are not at all clear. Accordingly, given present standards of technology and the present understanding of the complex interaction of lignin and cellulose, it is only possible to determine empirically the quality of paper produced through a given biological pulping process and the amount of any energy savings achieved through such a process.

10. None of the cited prior art references contain any empirical teaching as to the use of eucalyptus wood in a biokraft process to make a paper pulp. None of the cited prior art references even mention the possible use of eucalyptus in biopulping procedures.

11. As discussed in paragraph 9, as the nature of the white rot fungus-lignin relationship is not predictable, the teaching of biopulping methods utilizing white rot fungus with non-eucalyptus wood, would not suggest to one skilled in the art that the same methods and fungus species would necessarily be useful in the biopulping of a different species of wood.

12. The Baecker reference is directed at a method of microbial pre-treating wood chips for papermaking. The reference describes a process of growing fungi on wood chips during transport, but does not show any results depicting the benefits of using fungi in the kraft-pulping process. The Baecker reference also contains no disclosure of the use of eucalyptus wood.

13. The Yang reference relates to the bleaching of eucalyptus kraft pulp using the EnZone process. This reference contains no teaching or suggestion of any biopulping procedure. The reference is only related to a bleaching procedure for eucalyptus kraft pulp.

14. The '564 patent is directed towards a method of biopulping wood chips into a paper pulp. I am the sole inventor of the '564 patent. The patent specifically discloses examples of biopulping loblolly pine and aspen.

15. While the '564 Patent teaches a biopulping pulping method, the reference only contains empirical evidence of biopulping methods utilizing loblolly pine and aspen. Methods for biopulping eucalyptus are not discussed or suggested in the '564 patent. In fact, if these references teach or suggest any biokraft pulping process, it would be the biokraft pulping of loblolly pine and aspen, as these were the specific species taught in these references. However, when I used a biokraft pulping process similar to the presently claimed process on loblolly pine and aspen, it was found that a fungal pretreatment did not show any appreciable significant effect on the pulp yield, kappa number (residual lignin after cooking), and physical and optical properties of the pulp produced.

16. Using similar methods of the present invention, I performed a biokraft pulping process on loblolly pine chips. Loblolly pine chips of standard size were obtained from Union Camp Corporation, Alabama. The chips were then treated with *C. subvermispora* and incubated for two weeks. The cooking conditions are mentioned in Table 1 (See attached Exhibit B). The process involved cooking the control and fungus treated chips with the pulping liquor (active alkali and sodium sulfide) for 120 minutes. The temperature was brought up to 171°C slowly in about 60 minutes, so that chemicals penetrated throughout the chips uniformly (ramp time), then the cooking was performed at 171°C for 60 minutes (cooking time). The effectiveness of fungal pretreatment was evaluated based on kappa number, yield, and physical and optical properties of the resulting paper after cooking. Kappa number and the physical properties of pulps were measured following the TAPPI standard methods. Results on pulp yield and kappa number with fungal pretreatments are shown in Table 1 (See Exhibit B). I used various concentrations of active alkali and fixed 25% sulfidity concentration in the experiment. The alkali concentration in cooking

liquor was varied along with cooking time in order to obtain pulps at various yields and kappa levels. In each experiment set up I tried to compare the advantage of using fungus-treated chips over the non-treated control chips in kraft pulping processes. The preliminary results showed no apparent advantage of using fungus-treated chips over the control chips in terms of pulp yield and kappa number. The mechanical and optical properties of pulps obtained at various cooking conditions are presented in Table 2 (See Exhibit C). I found no significant difference in the properties of the pulp produced from control chips and fungus-treated chips cooked under identical conditions. The use of the white rot fungus species *Phanerochaete chrysosporium* on loblolly pine also have not shown any appreciable significant results with the kraft pulping process.

17. An experiment identical to that delineated in paragraph 16 was performed on aspen (a hardwood) and no significant differences in the properties of the pulp produced from control chips and fungus-treated chips cooked under identical conditions were found.

18. Based on the biokraft pulping experiments on loblolly pine and aspen, it was expected that the biokraft pulping of eucalyptus would produce similar results (i.e. no significant difference between the properties of the pulp produced from the control chips and the fungus-treated chips) however, when the method of the present invention is utilized with eucalyptus wood chips, unexpected results are achieved. The biokraft pulping method used with eucalyptus wood results in improved chemical pulping efficiency and pulp properties (brightness and strength). An experiment as set forth in Example 1 of the specification was performed using the white rot fungus species *Phanerochaete chrysosporium* (see pg. 13-15 of the specification. A biokraft eucalyptus pulp is compared to that of a control which was not treated by *Phanerochaete chrysosporium*. The unbleached brightness and the final brightness of the biokraft eucalyptus pulp is higher than that of the control pulp (See Table 13(a) on page 45). Additionally, the strength properties of the treated eucalyptus chips are greatly improved (See Table 13(b) on page 47 of the Specification). Furthermore, the beating time of the kraft process utilizing biotreated eucalyptus wood is reduced by 33%. Another unexpected result is that the improved characteristics of the biokraft eucalyptus pulp is maintained without the

addition of nutrients (specifically corn steep liquor) to the biotreated eucalyptus wood chips. Eucalyptus wood is very unique giving better results both with and without corn steep liquor. Such remarkable results have not been cited or suggested in the prior art with any other wood species tested.

19. The Office Action states that "It would have been obvious to the routineer to use the hardwood eucalyptus of Yang when making the Kraft pulp of Baecker." (Office Action p. 3). I disagree with this statement for two reasons. First, the references do not disclose or suggest that any methods of biokraft pulping could successfully be practiced with eucalyptus wood. Second, my own experiments conducted as outlined in paragraph 16 above, found that the biokraft pulping of loblolly pine and aspen (the species disclosed and taught by the '564 patent) did not produce biokraft pulp with any significant difference (in energy savings or paper quality) over standard kraft pulped loblolly pine and aspen. Given this knowledge, I do not believe even given the teachings of the cited references, one would have found it obvious to utilize eucalyptus in biokraft pulping methods with a reasonable expectation of success, namely the production of high quality pulp with reduced energy cost.

20. In summary, for reasons provided in paragraphs 8-19 above, I believe that none of the references cited in the Office Action, whether considered individually or in combination with one another, teach or suggest the methods of the present invention. I also believe that the results of the experiments illustrated in the present application and discussed above demonstrate that paper produced using the methods of the present invention have surprisingly superior properties, for reasons provided in paragraph 18, above.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 7/21/05

Masood Akhtar, Ph.D.

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Exhibit A

Masood Akhtar

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Masood Akhtar is President of the Center for Technology Transfer Inc. (CTT) in Madison, Wis. An entrepreneur with experience in technology transfer, Akhtar founded CTT in June 2002 to improve the competitiveness of Wisconsin businesses by accelerating the adoption of energy efficient and environmentally-friendly technologies. The private, nonprofit corporation is funded by Focus on Energy, Wisconsin's energy efficiency and renewable energy initiative.

Masood Akhtar also is Chief Executive Officer of BioPulping International, a University of Wisconsin spin-off, in Madison. He co-founded the company in 1996 to commercialize biopulping after serving as biopulping project leader at the University of Wisconsin Biotechnology Center/Forest Products Laboratory for 10 years. Biopulping is the treatment of wood chips with a "natural" wood decay prior to pulping. It reduces electricity consumption by at least 30 percent, improves paper strength, reduces the environmental impact of pulping and reduces operating costs by at least $5 million per year for an average paper plant.

Professional Qualifications

Adjunct Professor	Department of Paper, Printing Science & Engineering, Western Michigan University, Kalamazoo, MI
Post-doctoral fellow	Plant Pathology, Ohio State University, 1986
Ph.D.	Microbiology (Botany), Aligarh Muslim University, India, 1985
M.Phil.	Microbiology (Botany), Aligarh Muslim University, India, 1982
M.S.	Botany Department, Aligarh Muslim University, India, 1980
B.S.	Botany, Chemistry and Zoology; Rohilkhand University; India, 1978

Area of Expertise.

Strategic planning, Management, Technology Transfer, Grant Writing, and Entrepreneurship.

Positions Held

President	Center for Technology Transfer, Inc. Madison, WI, 2002-to date
CEO	BioPulping International, Madison, WI., 2000-to-date
Vice-President	BioPulping International, Madison, WI, 1996-2000
Project Leader	Biopulping Consortium, Institute for Microbial and Biochemical Technology, Forest Products Laboratory, Madison, WI, 1989-1996.

Honors and Awards

On the program committee of the Ninth International Conference on Biotechnology in the Pulp and Paper Industry, Durban, South Africa, 2004; In 2003, elected as a Fellow by the International Academy of Wood Science, UK; 2001 Wisconsin Small Business Innovation Award for Outstanding Achievements by the Wisconsin small Business Innovation Consortium; On the program committee of the Eighth International Conference on Biotechnology in the Pulp and Paper Industry, Helsinki, Finland, June, 2001; Best Poster Award for 1999. ACEEE Summer Study on Energy Efficiency in Industry; On the organizing committee of the 6th Brazilian symposium on the chemistry of lignins and other wood components, October 25-28, 1999 Guaratingueta, SP, Brazil; U.S. Forest Service Chief's award for 1998 for excellence in BioPulping technology transfer; On the organizing Committee of the Seventh International Conference on Biotechnology in the Pulp and Paper Industry, Canada, June 1998; Federal Laboratory Consortium Award for 1998 for excellence in BioPulping technology transfer; On the Program Committee of the Seventh International Conference on Biotechnology in the Pulp and Paper Industry, Vancouver June, 1998; USDA Honor Award, for 1997 for developing biopulping technology, Awarded by the U.S. Secretary of Agriculture in Washington, DC; Awarded a certificate by the University of Wisconsin Biotechnology Centre, Madison, Wisconsin on March 24, 1997 for an outstanding contribution in bringing basic research on biopulping to the practical application; Tappi Pulping Conference High Impact Paper Award, 3rd place, 1996; Asked by the American Chemical Society to organize a symposium on Environmentally Benign Pulping Methods, New Orleans, LA, March 1996; On the organizing Committee of the Sixth International Conference on Biotechnology in the Pulp and Paper Industry, Vienna, Austria, June, 1995.

Patents.

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Akhtar, M., M.J. Lentz, E.N. Lightfoot, G.M. Scott, Ross Swaney, and T.K. Kirk. Method and apparatus for commercial scale biopulping. A patent allowed in South Africa.

Akhtar, M., M.J. Lentz, G.M. Scott, R. E. Swaney, E. G. Horn, E.N. Lightfoot and T.K. Kirk. Method and apparatus for commercial scale biopulping (A worldwide patent filed, March 1998).

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G.M. Scott , M. Akhtar , R.E. Swaney , and C.J. Houtman. Recent developments in biopulping technology, Proceedings of the 8th international Conference on Biotechnology in the Pulp and Paper Industry, June 4-8, 2001, Helsinki, Finland.

G. M. Scott , Masood Akhtar ,Gary C. Myers , Marguerite S. Sykes , Ross E. Swaney. An update on biopulping commercialization. Proceedings of the 3rd Ecopapertech Conference, June 4-8, 2001, Helsinki, Finland, pp. 37-43.

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H.S. Sabharwal, M. Akhtar, R.A. Blanchette, and R.A. Young (1994). Bio-refiner mechanical pulping of bast type fibers. 1994 Tappi Pulping Conference, TAPPI Press, pp. 623-641 San Diego, CA.

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Scientific Presentations

About 70 papers presented before national and international scientific societies, technical conferences etc.

Funds

Pulp and paper and related industry $375,000; University of Wisconsin $ 82,552; United States Department of Agriculture Competitive Grant $ 155,817; Energy Center of Wisconsin $ 230,000; Energy Center of Wisconsin $ 127,459; Clariant (Sandoz) Corporation $50,000; Cooperative Research and Development Program $ 66,000; UPM-Kymmene, Finland $7,500; Recycling Market Development Board, Department of Commerce, $10,000; Small Business Innovation Grant/USDA (Phase 1)-$70,000; United States Department of Agriculture Competitive Grant, $81, 820; Wisconsin Department of Commerce-$196,500; US Department of Energy (Inventions and innovation Program), $200,000; Biopulping International, Inc.'s contract (RFP) with MSOE-$300,000; US Department of Energy (National Industrial Competitiveness through Energy, environment and Economics Program), $525,000; Small Business Innovation Grant/USDA (Phase 2)-$295,619; Focus on Energy to establish the Center for Technology transfer (CTT) $300,000 (July 1 2002-June 30, 2003) and approximately $4.5 million (July 1 2003-June 30, 2005) plus additional $3 million leverage with Impact Seven, another non-profit organization in Wisconsin.

Media Interviews

Wisconsin Public Radio (April 19, 2004), Fond du Lac Radio (March 23, 2004), and Milwaukee Public Radio (March 17, 2004) interviews on Center for Technology Transfer; Wisconsin State Journal, May 21, 2002, Will white-rot fungus save paper industry?' The Capital Times. February 6-7, 1999, Wisconsin Ideas; Printprocess (German publication), June 1999, Munching fungi; Agricultural Facts, National Public Radio, August 18, 1998, September 4, 1998; Resource Recovery Report, 5313 38th St. NW, Washington, DC, Paper, Vol. XXII No. 6, April 1998, p. 9; Chemical & Engineering News, American Chemical Society, New age paper and textile, March 23, 1998, vol. 76, No. 12, 39-47; Energy Efficiency Newsletter, The Energy Center of Wisconsin, Fall 1997, Vol. 2, Number 4, Biopulping is excellent; Wisconsin State Journal, August 28, 1997. Fungus helps to pulp wood; Wisconsin Channel 27, News item, Sunday, August 3, 1997, Biopulping; Isthmus, Vol. 22, No. 25 June 20-25, 1997. A dirty business. Should the paper industry be doing more to clean up its act? p. 9; PAPERA, Vol. 1, Nov. 2, June 1997, Biopulping: A new pulping technology. Institute of Paper Science and Technology; Renewal Energy Annual 1996. Published by the Energy Information Administration (EIA), U.S. Department of Energy, Washington, D.C. in March 1997. Biopulping: New biomass technology on the industrial horizon;The Forestry Source published by the Society of American Foresters, November Issue, 1996, p. 10, Researchers discover fungus that could save papermakers millions Wisconsin Channel 27, News Item, Tuesday, October 31, 1996, Biopulping; The Capital Times, October 16, 1996, Pulp friction Wisconsin Channel 27, News item, Friday, September 27, 1996, Biopulping; Milwaukee Journal Sentinel, September 26, 1996, Fungus could save papermakers millions; Wisconsin Public Radio, September 10, 1996, biopulping; Energy Efficiency Newsletter, The Energy Center of Wisconsin, Summer 1996, Vol. 1, Number 3, Fungus Invades Wisconsin paper mill; Channel 15, New Item, Tuesday, November 29, 1994; New Uses Council Ag Industrial Materials & Products, March 1994, New-biopulping method could enhance potential of paper making from kenaf, a non-wood plant; Wisconsin Channel 27, News item, Wednesday, November 24, 1993, Biopulping State of Wisconsin, Department of Natural Resources, Monday, Nov. 8, 1993; USDA TV News item (Washington, D.C.), August 1993, Biopulping; Wisconsin State Journal, Monday, April 12, 1993, Researchers pitch "biopulping"

Exhibit B

Table 1. Pulping conditions, and pulp yield and kappa number after cooking of control and fungus-treated chips

Treatments number	Active alkali (%)	Ramp time (min.)	Cooking time (min.)	Cooking temperature (°C)	Yield (%)	Kappa
BATCH 1						
Control	20	60	60	171	44.3	31.5
Treatment (-CSL)[a]	20	60	60	171	44.6	30.5
Treatment (+CSL)[b]	20	60	60	171	43.6	32.8
BATCH 2						
Control	18	60	75	171	45.1	34.3
Treatment (-CSL)[a]	18	60	75	171	45.3	32.4
Treatment (+CSL)[b]	18	60	75	171	46.3	34.3
BATCH 3						
Control	16	60	60	171	47.6	53.0
Treatment (-CSL)[a]	16	60	60	171	48.0	53.0
Treatment (+CSL)[b]	16	60	60	171	48.0	55.0

Sulfidity (Sodium sulfide): 25%
Liquor-to-wood ratio: 4

[a] *Ceriporiopsis subvermispora* SS-3 treated loblolly pine chips for two weeks without CSL (corn steep liquor)
[b] *Ceriporiopsis subvermispora* SS-3 treated loblolly pine chips for two weeks with CSL (corn steep liquor)

Exhibit C

Table 2. Physical and optical properties of unbleached pulps obtained after cooking of control and fungus-treated chips

Treatments coefficient	CSF (ml)	Burst index (kN/g)	Tear index ($mN.m^2/g$)	Tensile index (Nm/g)	Brightness (%)	Opacity (%)	Scattering (m^2/kg)
BATCH 1							
Control	450	6.3	13.3	85	17.5	82	8.2
Treatment (-CSL)	450	6.4	13.8	84	19.3	85	9.6
Treatment (+CSL)	450	6.3	13.0	85	18.2	85	9.0
BATCH 2							
Control	450	6.6	13.7	89	17.4	94	12.0
Treatment (-CSL)	450	6.6	13.4	85	17.0	94	12.0
Treatment (+CSL)	450	6.7	12.6	88	16.0	95	12.0
BATCH 3							
Control	450	6.8	13.5	87	15.2	95	11.8
Treatment (-CSL)	450	6.3	14.0	85	15.4	95	12.0
Treatment (+CSL)	450	6.6	13.8	84	15.0	95	12.0